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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,628	08/01/2003	Bradley J. Howard	2269-5862US (02-1563.00/	4766

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
12/22/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTOMail@traskbritt.com

Office Action Summary	Application No.	Applicant(s)	
	10/632,628	HOWARD, BRADLEY J.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-9 and 11-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-9 and 11-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/9/08 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 1, 3-9, and 11-23 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 16 by adding new limitation "wherein each of the second and third power generators are configured to independently apply energy directly to the lower electrode entirely to generate the at least two different active states thereon".

Claims 1, 3-9 and 11-23 are presently pending and active.

New reference by Suemasa et al {US 6,089,181) when combined with Chen et al, Tsuchiya et al and Suzuki reads on amended claims 1, 16 limitations including the newly added limitation "wherein each of the second and third power generators are configured to independently apply energy directly to the lower electrode entirely to generate the at least two different active states thereon", as explained below. Further, balance claims 3-9, 11-15 and 17-23 have also been rejected under 35 USC 103 (a) as explained below.

Regarding applicant's argument that Suzuki does not teach or suggest activating the second and third power generators to generate at least two different active states on the lower

electrode, examiner responds that Tsuchiya et al teach a controller 20 that can be configured to individually selectively control the activation configuration of the first and second power generators 29, 18 during a plurality of phases of a duty cycle of a process to enable optimize the etching process for etching rate, uniformity of etching and selectivity ratio (e.g. Fig. 1, 30-33 and col. 4, line 45 to col. 6, line 45 and col. 12, line 5 to col. 13, line 35). Further, Suemasa et al teach a plasma apparatus comprising a lower electrode 110 that is supplied with a combination circuit of superposed RF power directly from a RF source 140 and another RF source 148 whose power is modulated and applied to the lower electrode (e.g. Fig. 1 and col. 3, line 40 to col. 5, line 30). Still further, Suzuki teaches a plasma etching apparatus comprising a controller (timing controller) 22 that can differently activate two different generators 18a, 18b such that timing relationship of the two microwave generators can be controlled as desired, i.e. two portions of the plasma source can be activated to two different states by differently activating the two generators 18a, 18b such that different activated states of the microwaves can pass through dielectric window 26. Suzuki additionally teaches that the timing controller 22 can also control timing relationships of the two microwave generators and the bias voltage through pulse generators 22a, 22b, 22c (e.g. Figs. 1, 2 and col. 6, line 60 to col. 7, line 28). Suzuki also teaches that the apparatus can also be applied to other type of apparatus like besides ICP, RIE etc. It would be obvious to configure the controller for differently activating the second and third generators so as to generate at least two different active states on the same (lower) electrode, wherein each of the second and third power generators are configured to independently apply energy directly to the same electrode entirely, as per teaching of Suemasa et al and Suzuki to obtain plasma etching process with improved etching rate and selectivity. Regarding applicant's contention that the cited references lack teaching or suggestion for the second and third power

generators being configured to independently apply energy directly to the lower electrode entirely to generate the at least two different active states, examiner responds that Suemasa et al teach second and third power generators 140, 148 that are configured to independently apply energy directly to the lower electrode 110 entirely. Further, Suzuki teaches configuring two RF power generators so as to generate two active states in the chamber. It would be obvious to configure the controller for generating two active states when RF power is applied to the entire lower electrode in view of teaching of Suemasa et al, and Suzuki's teaching that his invention could be applied to other type of plasma apparatus like inductive , RIE etc to obtain improved etching rate and selectivity. Thus, Chen et al, in view of Tsuchiya et al, Suemasa et al and Suzuki teach all limitations of the claims 1, 16 as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-9, 11-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (US 2004/0025791) in view of Tsuchiya et al (US 5,716,534), Suemasa et al (US 6,089,181) and Suzuki (US 6,756,311).

Regarding Claims 1, 16, 17: Chen et al teach a plasma etching apparatus comprising:

first, second and third power generators 162, 150, 154 wherein the first power generator 162 is coupled to an upper electrode 174 and the second and third power generators 150, 154 are coupled to a lower electrode 120 for supporting a wafer thereon, the first, second and third power generators being frequency- based power generators; a controller 110 configured to control the three frequency based power generators as per process limitations like plasma density, size of wafer etc. Chen et al further teach that the second and third generators 150, 154 enable to supply a modulated bias signal to the lower electrode 120 to provide improved selectivity and an increased process window (e.g. Fig. 1 and para. 0018-0035, 0050-0052).

Chen et al do not teach a controller configured to individually selectively activate the first, second and third power generators to a plurality of activation configurations during a plurality of phases of a duty cycle of a process, wherein at least one of the plurality of activation configurations includes differently activating the second and third power generators to generate at least two different active states on the lower electrode, wherein each of the second and third power generators are configured to independently apply energy directly to the lower electrode entirely to generate the at least two different active states thereon.

Tsuchiya et al teach a plasma apparatus comprising a first and second frequency based power generators 29, 18 connected to electrodes 21 (upper electrode) and 4 (lower electrode) respectively. Tsuchiya et al further teach a controller 20 that can be configured to individually selectively control the activation configuration of the first and second power generators 29, 18

during a plurality of phases of a duty cycle of a process to enable optimize the etching process for etching rate, uniformity of etching and selectivity ratio (e.g. Fig. 1, 30-33 and col. 4, line 45 to col. 6, line 45 and col. 12, line 5 to col. 13, line 35). Though Tsuchiya et al do not teach the controller is configured such that at least one of the plurality of activation configurations includes differently activating two power generators (second and third generators) that are connected to the same (lower) electrode, it would be obvious to configure the controller of Tsuchiya et al for differently activating the second and third power generators 150, 154 in Chen et al's apparatus to obtain optimization of etching rate, uniformity of etching rate and etching selectivity ratio coupled with an increased process window during etch processing.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to configure the controller so as to individually selectively control the activation configuration of the first and second power generators during a plurality of phases of a duty cycle of a process so that at least one of the plurality of activation configurations includes differently activating the second and third generators as taught by Tsuchiya et al in the apparatus of Chen et al to enable optimize the etching process for etching rate, selectivity ratio and uniformity of etching rate coupled with an increased process window during etch processing.

Chen et al in view of Tsuchiya et al do not teach the controller is configured to activate the second power generators to generate at least two different active states on the same electrode wherein each of the second and third power generators are configured to independently apply energy directly to the lower electrode entirely to generate the at least two different active states thereon.

Suemasa et al teach a plasma apparatus comprising a lower electrode 110 that is supplied with a combination circuit of superposed RF power from an RF source 140 and another RF

source 148 whose power is modulated and applied to the lower electrode, which enables to obtain higher selectivity and etch rate (e.g. Fig. 1 and col. 3, line 40 to col. 5, line 30). It would be obvious to configure the controller of Tsuchiya et al for differently activating the second and third power generators 150, 154 in Chen et al's apparatus wherein each of the second and third power generators are configured to independently apply energy directly to the lower electrode entirely to obtain improved etching rate and etching selectivity.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to configure each of the second and third power generators independently apply energy directly to the lower electrode entirely as taught by Suemasa et al in the apparatus of Chen et al in view of Tsuchiya et al to obtain improved selectivity and etching rate.

Chen et al in view of Tsuchiya et al and Suemasa et al do not teach the controller is configured to activate the second and third power generators to generate at least two different active states on the same electrode.

Suzuki teaches a plasma etching apparatus comprising a controller (timing controller) 22 that can differently activate two different generators 18a, 18b such that timing relationship of the two microwave generators can be controlled as desired, i.e. two portions of the plasma source can be activated to two different states by differently activating the two generators 18a, 18b such that different activated states of the microwaves can pass through dielectric window 26. Suzuki additionally teaches that the timing controller 22 can also control timing relationships of the two microwave generators and the bias voltage through pulse generators 22a, 22b, 22c (e.g. Figs. 1, 2 and col. 6, line 60 to col. 7, line 28). Suzuki also teaches that the apparatus can also be applied to other type of apparatus like besides ICP, RIE etc. It would be obvious to configure the controller for differently activating the second and third generators so as to generate at least two different

active states on the same (lower) electrode, wherein each of the second and third power generators are configured to independently apply energy directly to the same electrode entirely, as per teaching of Suemasa et al and Suzuki to obtain plasma etching process with improved etching rate and selectivity.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to configure the controller so as to activate the second and third power generators to generate at least two different active states on the same electrode as taught by Suzuki in the apparatus of Chen et al in view of Tsuchiya et al to obtain plasma etching process with higher etching rate and etching selectivity.

Regarding Claims 3, 4, 20: Chen et al teach that second power generator 154 can operate at 13.56 MHz, and the third power generator 150 operates at 2 MHz (that is second power generator operates with at least three times an operational frequency of third power generator, as per claim 3 limitation) {paragraph 003}. Further Chen et al also teach that first power generator 162 is configured to operate at a frequency of 40-180 MHz, which is greater than frequencies of second and third power generators, as per claim 4 limitation (paragraph 0022).

Regarding Claims 5-9, 11: Tsuchiya et al teach all limitations of the claims including that apparatus (Figure 1) uses CPU (controller) 20 to control power supplies 18, 29 for ON/OFF (active /inactive) modes to optimize the etching parameters (column 9, lines 1-15 and column 12, lines 45-65 and column 13, lines 1-25). Tsuchiya et al further teach that etching parameters can be optimized by appropriately selecting the parameters including phase difference and the power ratio of the generators (column 8, lines 20-25).

Regarding Claims 13, 21: Chen et al teach that second power generator 154 can operate between 4 MHz to 60 MHz (for example 13.56 MHz) which is within the claimed frequency

range of 13.5 MHZ to 60 MHz, that is, the prior art anticipates the claimed frequency range (paragraph 0031).

Regarding Claims 12,18,19: Chen et al in view of Tsuchiya et al teach that first power generator 29 is capacitively coupled to upper electrode 21, and second and third power generators 150, 154 are capacitively coupled to lower electrode 120 (Tsuchiya et al - Figure 1 and Chen et al – Figure 1).

Regarding Claims 14,22: Chen et al teach that first power generator 162 can operate in the range of 40-180 MHz, which includes the clamed frequency range of 40 MHz to 100 MHz (paragraph 0022). It would be obvious to adjust the frequency of first power generator as per process limitations like size of substrate, type of gases used.

Regarding Claims 15,23: Chen et al teach that power generator 150 (third power generator) operates at a frequency of 2 MHz, which anticipates the claimed frequency range of 1 MHz to 13.5 MHz (paragraph 0033).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free)..

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/K. M./
Primary Examiner, Art Unit 1792